NAVAL WAR COLLEGE

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NETWORK-CENTRIC WARFARE AND OPERATIONAL FIRES:
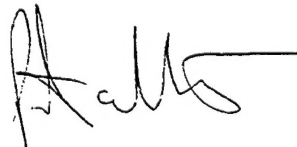
A MATCH FOR THE FUTURE

By

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

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15. Abstract:
      Many people don't believe that Network Centric Warfare (NCW) is accomplishable given the facts as they are presented in the numerous magazine articles and books. Some argue that the concept is fine, but we will be unable to build the system and operate it as described. Others argue that the concept itself is flawed. This paper will argue one aspect of Network Centric Warfare—speed—as it applies to the ability to conduct operational fires. It will show the trend for speed and present some current day technologies that support the projected speed based around the NCW concept. It will also show that the NCW concept *is* achievable and will enable operational fires effects to become drastically faster than present day fires. Speed of effects -- the power to rapidly produce a desired result -- enabled through the evolutionary concept of Network Centric Warfare, will significantly impact warfighting, as we know it.

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"Emerging Joint and service doctrine and future warfighting concepts address the imperative for accelerating the pace of movement of forces, maintaining an unrelenting operational tempo and decisively engaging the enemy and impacting events at the time and place of our choosing."[1]

Many people don't believe that Network Centric Warfare (NCW) is accomplishable given the facts as they are presented in the numerous magazine articles and books.[2] Some argue that the concept is fine, but we will be unable to build the system and operate it as described. Others argue that the concept itself is flawed. This paper will argue one aspect of Network Centric Warfare—speed—as it applies to the ability to conduct operational fires. It will show the trend for speed and present some current day technologies that support the projected speed based around the NCW concept. It will also show that the NCW concept *is* achievable and will enable operational fires effects to become drastically faster than present day fires. Speed of effects[3] -- the power to rapidly produce a desired result -- enabled through the evolutionary concept of Network Centric Warfare, will significantly impact warfighting, as we know it.

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[1] Knowledge and Speed: The annual report on the Army after next project to the Chiefs of Staff of the Army, July 1997

[2] Based on a survey conducted at the Naval War College in December 1999. Approximately 40% of the Junior class students (who replied to the survey) did not believe NCW was achievable in the next 15 years. See Annex A.

[3] Webster's Dictionary defines speed as "rate of action or movement; quickness; rapid motion." It goes on to define Effect as "Something produced by a cause; the power to produce a desired result; the reaction something has on an object; a technique which produces an intended impression." Therefore, my definition of "speed of effects."

FORCE

"War is an act of force to compel our enemy to do our will."[4]

Traditionally, wars were fought through attrition or annihilation warfare. However, an alternate concept based on the control of an adversary can be attributed to Sun Tzu who said " those skilled in war subdue the enemy's army without battle. They capture his cities without assaulting them and overthrow his state without protracted operations."[5] Rather than operationally destroying an enemy's military/army, destruction could be used only to affect each system the enemy organization relies on to conduct operations or exert influence. The goal is to prevent the enemy's use of force and therefore foil his execution of the plan. Effective control over adversary systems theoretically can achieve the political objectives that warranted the use of force in the first place.[6] In other words, using force wisely can compel our enemy to do our will without annihilating him.

Using force to achieve specific effects against critical system components to render that system ineffective, lead us to a much more efficient and effective use of our weapons, while gaining the same effect as destroying it.[7] Using weapons more efficiently naturally leads to the ability to produce more effects from the same amount of

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[4] Clausewitz, Carl von. On War. (Princeton University Press, NJ, 1984), 75
[5] Sun Tzu, The Art of War, trans. By Samuel B. Griffith (New York: Oxford University Press, 1971), 79.
[6] Deptula, David A. Firing for Effect: Change in the nature of warfare. (Aerospace Education Foundation, 1995), 5
[7] Ibid, 5

weapons, increasing the combat power while holding the number of platforms the same. (See Figure 1).
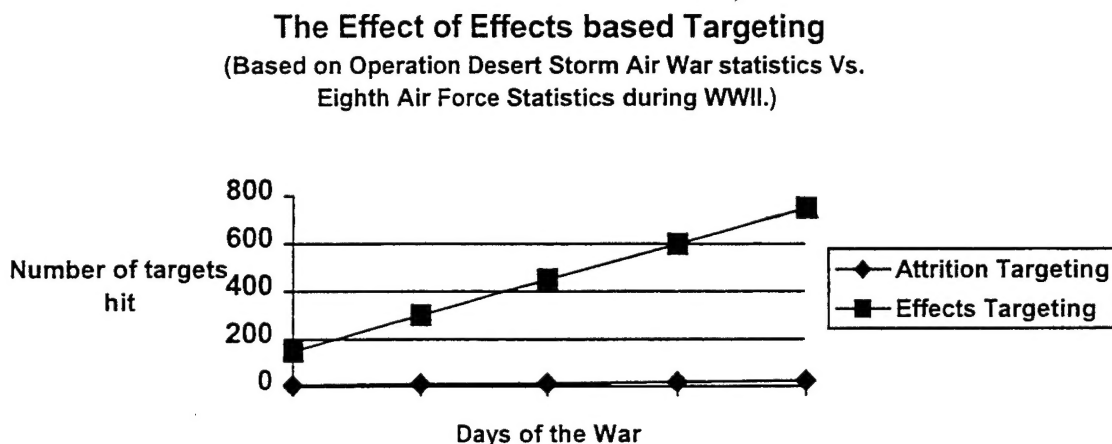
The Effect of Effects based Targeting
(Based on Operation Desert Storm Air War statistics Vs. Eighth Air Force Statistics during WWII.)

Figure 1[8],[9]

Imbedded in the NCW concept is the ability to map, monitor and, ultimately, understand how an enemy uses his "systems" to conduct war. The databases, reachback and computing ability that NCW will give to the operational planner will provide the targeting capability needed to produce an effective "effects based" targeting capability. The fallout of this capability is the conservation of forces, thus, in effect, increasing the combat power of our force, without increasing the number of combat platforms.

THE ABILITY TO MAKE WAR FASTER

"Avoid war, but if it is inevitable, end it quickly."[10]

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[8] Ibid, 1

[9] Also see, Friedman, George and Meredith. The Future of War. (St. Martin's Griffin, NY, 1996). 213 for more statistics

[10] Lecture by Prof Waghelstein, Naval War College, 14 December 1999

Speed is the most profitable effect of the Network-Centric Warfare (NCW) concept. The need for speed in command, speed in maneuver warfare, speed in response, etc., is a proven commodity in war. Using the offensive principle of war by maintaining offensive action while exploiting the initiative is still the most effective and desisive way to pursue an enemy.[11] Innovative use of technology has given Operational Commanders the ability to control the tempo of operations, usually to the point of overwhelming the enemy as desired. For example, airpower in WWII sped up the ability to conduct large-scale strikes on operational level targets making these targets more accessible than ever before. Fast carrier forces and land based bombers were used as operational fires in the maritime theatre. Although there were severe limitations on the effect of the weapons used during the war (discussed later), the ability to conduct operational fires on a large scale had arrived. In Figure 2, a first order analysis of the percentage of operational fires
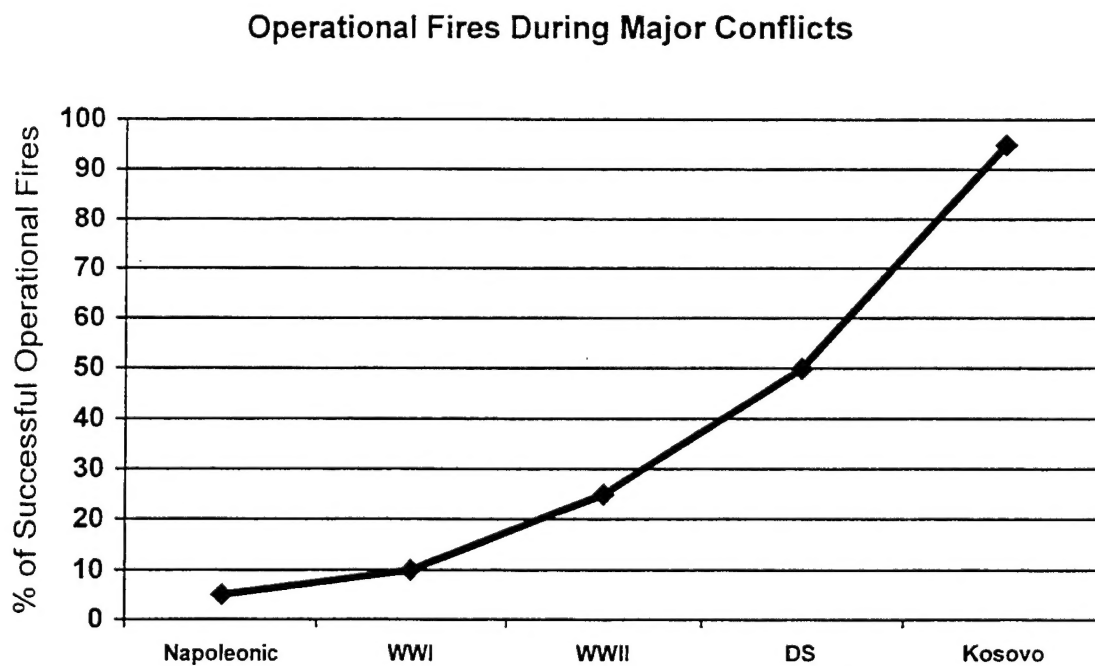
Operational Fires During Major Conflicts

Figure 2

[11] Hughes, Wayne. The Principle of the Offensive. Fleet Tactics (USNI, 1986), 25, 34-39, also Vego, Milan. On Operational Art, 4th Draft. (NWC 1035, 1999). 195

when compared to total fires, shows the rising trend in the use of operational fires over time. Put another way, as time progresses, operational fires form a greater percentage of total fires, making their importance, by default, more important to the overall success of the operation. As our ability to produce a decisive impact on the outcome of major operations through fires increases, the use of these fires increases.

In Desert Storm, access to operational targets sped up the ability of the attackers to hit operational and strategic level targets to vastly shorten a potentially long and deadly conflict. With few exceptions, operational target attacks were on a three-day cycle (the Air Tasking Order cycle). The three-day cycle worked in the Gulf War, but the ability to react to operational targets faster than a three-day ATO cycle was needed. Present day operation Southern Watch uses speed of command and control to effectively target tactical pop-up threats within hours of their discovery.[12] This capability, although significant in its ability, just gives us a taste of future things to come. It goes to reason, that the faster we can accomplish the operational fires plan, the more effective operational (and tactical) action will become and the faster the conflict will come to a conclusion.

The ability to speed up the process of warfare has been accomplished through the use of better communications to transmit knowledge. Telegraph, rail, telephone, radio, satellite, cellular telephones and the Internet are but some examples of communications techniques used through time. With the ability to transfer knowledge comes a distinct rise in the ability to speed up warfare.

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[12] Although this is an example of a tactical target, in theory, operational level targets could be targeted as well.

The capability to project power is inherently linked to the ability to communicate in a timely manner. The US is in a unique position since it is one of the few (if not only) countries practicing world wide power projection. As communications get better, the ability to project power in a timely manner increases. Since the ability to project power throughout the world has been demonstrated, what remains is to decrease the costs in manpower, capital equipment and consumables such as fuel and weapons. There are two ways to increase the power projection (and operational fires) capability of the US: better weapons effects and faster informational flows to aid in decision making. The same technology that permits us to see targets thousands of miles away is the same technology that permits us to strike at that target without using historical weapons platforms. If we can see an enemy target, we can now strike it without putting troops in harm's way.[13]

WEAPONS EFFECTS

The increased range, accuracy and lethality of modern weapons offer a corresponding increase in options for their operational employment.[14] However accuracy, precision and adequate lethality are the key to a successful engagement. With these attributes, weapons can be relied upon to have the effect on the target the commander requires.

Many thousands of tons of ordnance were expended in WWII to blow up a single building while only one or two tons of ordnance was needed in Kosovo to achieve the

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[13] Friedman, 37
[14] Vego, 308

same effect. This trend in accuracy will continue far into the future. With precision-guided munitions, the number of people in arms should decline precipitously—one projectile can be fired for every thousand previously needed. More important, the level of undesired devastation to achieve the desired effect will decline as well. The relative light damage to Baghdad in the six-week bombing campaign of Desert Storm, compared, for example, to the damage to Hanoi in the Christmas bombing, is a foretaste of a more efficient sort of war.[15]

Accuracy, speed and new control technology will lead to new weapons. But, new weapons must be backward compatible since the Navy is currently filled with legacy systems and will continue to have them ad infinitum. The great thing about most projectiles is that most, if not all, can be backfitted with miniature GPS/INS navigation packages[16] and with meso-spoiler control surfaces.[17] Navigation systems feeding highly accurate and efficient flight controls will make these projectiles pinpoint accurate.

The projectiles do not need to be expensive.[18] Cheap, precise projectiles enable fire support from the sea called for by the USMC Operational Maneuver From The Sea (OMFTS)[19] document. For example, long range gun projectiles currently under development by the Science Application International Corporations (SAIC) – the 63NM Barrage Round – require digital coordinates prior to being shot from the gun, however,

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[15] Friedman, 393

[16] Draper Labs (among others) have made miniature GPS/INS navigation units as small as 3 square inches. Projections are for much smaller units by 2002 based on MEMS technology, that can fit on a small computer chip.

[17] Interview with Dr. Chih-Ming Ho at UCLA, Letter from Prof Narayan Komerath to LCDR Pete McVety, http://www.ae.gatech.edu/research/windtunnel/classes/unstaero/Arbaero.html, Georgia Tech and interview with Dr. Shiv Joshi, University of Texas at Arlington

[18] One cost estimate is $35,000 for a 16/11 inch, long range, GPS concept shell with discarding sabot. Lehman, John F. "Keep the Big Guns". Proceedings, January 2000, p46

[19] Operational Maneuver From The Sea. Surface Warfare, (July/August 1996, Vol. 21, No. 4),13

the plan is to make the round retargetable (or at least updateable) in-flight. The

implications of this are the possibility of a seakerless munition hitting a moving target

through the use of in-flight target updates (IFTU). This ability relies on digital, wireless

communication to the round while it is in flight, a capability that will be resident in the

NCW concept, since this capability is available now! This, at first, might seem to be an

impossible feat, given present day hardware, however, that is not the case. An update

rate of 5Hz with 600 bits per IFTU of information (per the Navy Science Board) is

predicted to be the most needed to supply a projectile with enough information to guide it

against a 60 MPH vehicle.[20] The ability to transmit these signals exists today in

SATCOM UHF and GPS message capabilities. This is the capability that will be used to

retarget the Tactical Tomahawk in flight and could be used to retarget other GPS

weapons in-flight. Accuracy, enabled by new control technology will make almost all

projectiles precision guided capable.

For the Operational Commander, once he has precision on every projectile, the

actual volume of fire needed to kill a target drastically decreases[21] as can be seen in

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[20] Memo by Mr. John G. Kammerer, C4ISR Systems Engineer, SPAWAR Systems Center to LCDR Peter McVety, 30 November 1999

[21] JMEMS shows us that there can be magnitudes of difference, in ordnance required to destroy a target, between free fall bombs and precision weapons.

Figure 3 and Figure 4[22]. This reduces the numbers of sorties/tonnage needed to affect the
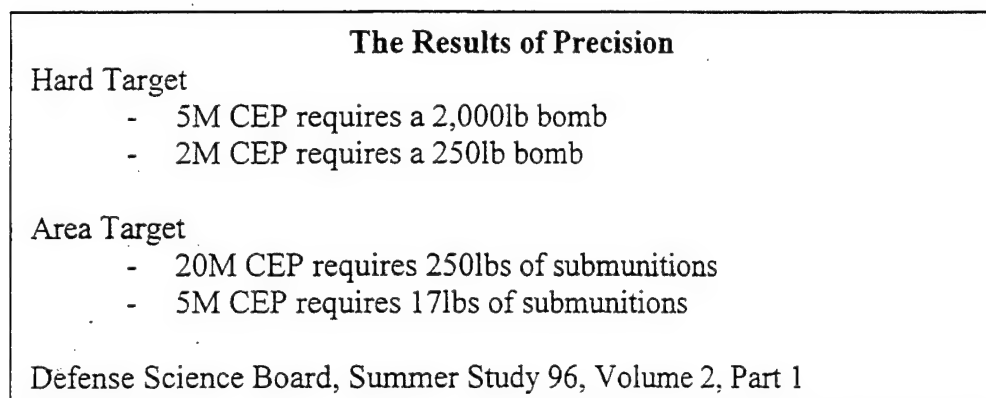
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┌─────────────────────────────────────────────────────────┐
│                   The Results of Precision                │
│  Hard Target                                              │
│         -    5M CEP requires a 2,000lb bomb               │
│         -    2M CEP requires a 250lb bomb                 │
│                                                           │
│  Area Target                                              │
│         -    20M CEP requires 250lbs of submunitions      │
│         -    5M CEP requires 17lbs of submunitions        │
│                                                           │
│  Defense Science Board, Summer Study 96, Volume 2, Part 1 │
└─────────────────────────────────────────────────────────┘
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Figure 3

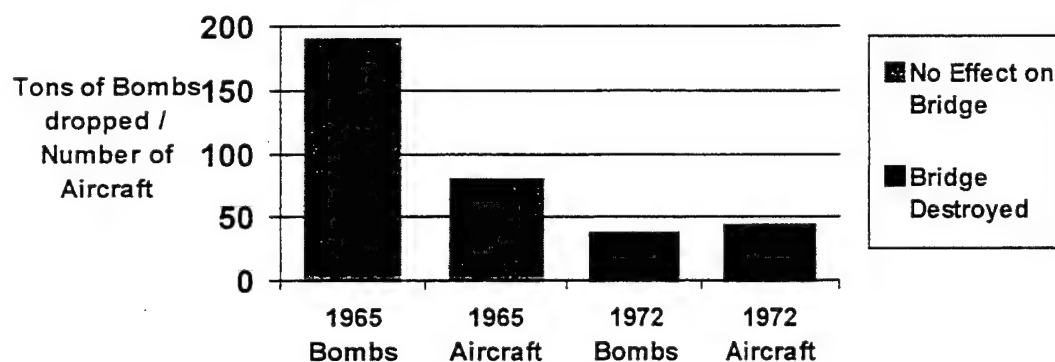**Effects of Precision on the Thanh Hoa Bridge**

Figure 4[22]

target. Reason then dictates that with the same number of assets, a commander is able to

plan and affect more targets in the same amount of time, speeding up the waging of war.

Not all weapons will have to fly faster to get to their target in a timely manner.

Hypersonic missiles can be used to reduce the time of flight and time of response to a

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[22] Friedman, 239-240

target, but at greater expense to the forces. Instead, pre-positioned (on-call) munitions should fit the bill for time of flight. NCW will enable the use of loitering munitions to shorten the timeline of detection to destruction of moveable targets. The ability to loiter weapons and re-target them in-flight exits today and supports the NCW speed of operational fires concept. Today, a loitering FA-18 with a JDAM only has to receive the coordinates of a target, fly to a suitable launch point and drop the munition. A process that, once the decision is made to hit the target, only takes minutes to accomplish... today. At the present time, this process is extremely manpower intensive and is fraught with the limitations of passing coordinates through several C2 voice circuits to the pilot. However, the proof of concept for rapid, in-flight targeting of time critical targets is being applied in Operation Southern Watch today. Digital communications enabled by the NCW backbone will only increase the speed and accuracy of the targeting information sent to the airplane. NCW might even change the cycle assignments, so that all aircraft takeoff without target assignments, only to receive them in the air, basically playing a zone defense in the sky vice a man to man defense.

SPEED OF DECISIONS

The slowest and hardest piece of the operational fires piece is making the decision to shoot at a target. Of course, the decision to shoot at a target usually relies on the information available to determine if the target is viable. In respect to operational fires, most targets are pre-planned (by definition of operational fires). However, the operational targets that are not pre-planned (such as WMD, long range missile launchers,

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large moving formations, ships at sea) may have a very short time of vulnerability. Doctrine and ROE play an ever-increasing role in speed of operational fires (as well as tactical fires) by having the operational Commander make a decision about certain events before they happen. Automatic protocols, based on these pre-made decisions, will be able to reduce the speed of the decision making process, if the automatic protocols are allowed to take over the engagement. There are numerous automatic target recognition (ATR) programs, sponsored by all three services. Several of these programs show great promise for useable, fully automated target recognition.

The problem today is less the gathering of data to make the decision and then rendering the data as information, as it is to make the data usable. Our systems in place provide data but not in a manner compatible with the normal sense and thought process of the decision-maker.

New sensor technologies (Automatic target recognition, multi-spectral imaging, etc) and ISR systems information fusion are some of the technologies that are being worked on and developed today. The military is taking a stepping stone approach to integrating the new technology into a workable system. While the fusion of sensor and information systems does not exist at this time, the means to display the information does exist in several ongoing programs such as SimNet and the Dismounted Infantry Virtual Environment (DIVE) US Army programs. SimNet and DIVE are designed to train infantrymen, tank drivers and gunners in a virtual reality environment. Both of these programs will lead into a "nonvirtual" reality which will extend the infantryman's physical senses into distant spaces. The experience will be undistorted—he will

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understand what is happening around him as quickly as if he were using his own eyes and ears. In other words, the each soldier will have situational awareness available to them.

Also, the old problem of command and control in combat, as well as some parts of the problem of unit cohesion, will be solved or at least, eased. The commander's sense of where his men are and what they are doing will be greater than at any time since warfare became a large enough enterprise that it extended beyond the reach of a commander's eyes and voice. The backbone information system and concept of this system is the same one as used by the weapons systems, enabled by the NCW concept.[23]

Although the military may be able to move quickly to lockout enemy options, politicians may be limited by diplomatic or other constraints. Even single changes to rules of engagement may take hours to decide upon. In many cases where the United States enjoys overwhelming force, the military may wish to move as quickly as possible to secure rapid, unconditional surrender. On the other hand, political strategists may wish to move more slowly—to employ a 'shoot-negotiate-shoot' approach in order to retain international respectability. These intangibles are the reality in which we live in, however, whether the capability is utilized or not does not negate the *potential* of the system to achieve combat success. The job of the military is to give the National Command Authority the best choice of options in a crisis, something NCW today and in the future will provide.

As we as a nation continue to understand how an adversaries system works, the use of operational fires during a crisis will continue to be heavily relied upon to solve that

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[23] Although this example can be viewed as a tactical example, it is just one of many programs that will enable speed of command and situational awareness, not only at the tactical level, but also at the operational and strategic level of war.

crisis. The effects of rapidly targeting guided munitions will increase the capability of the operational commander to shape and mold the battlefield to his liking. The speed at which he will be able to operate will be enabled through the NCW concept. This capability will significantly impact warfare, enabling the United States to drastically speed up the tempo of operations, ultimately overwhelming an enemy in a very short time.

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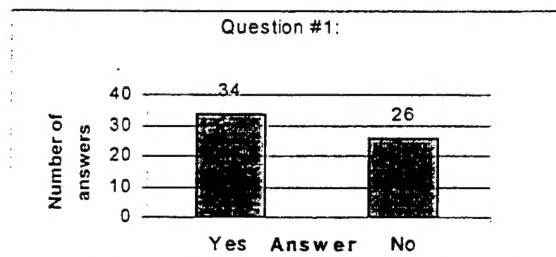
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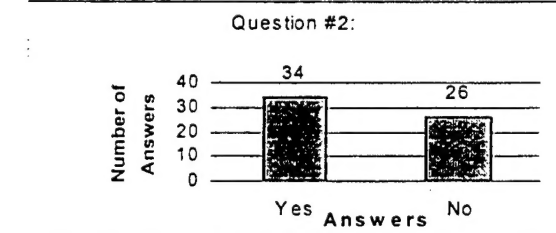Tirpak, John A. "The robotic Air Force." (Air Force Magazine, Sept 1997)

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ANNEX A

Question #1:

|	Yes	No
Do you believe that the Network Centric Warfare concept is achievable in the next 10-15 years?	34	26
Percentages:	56.67%	43.33%

Question #2:

	Yes	No
Do you think JV-2010 is achievable in the next 10-15 yrs?	34	26
Percentages:	56.67%	43.33%

Question #3:

	A	B	C	D	E	F	G	
What do you see as the major problems in achieving the NCW goal?	19	21	20	14	29	10	3	
Percentages:	14.50%	18.10%	15.27%	10.69%	22.14%	7.63%	2.29%	11

Nswers:

A. Computer Software

B. Computer Hardware

C. Platforms

D. Doctrine/ROE

E. Inability of the concept to gain momentum against currently planned systems in the DON

F. Inability of the concept to gain acceptance in "the system" outside the DON

G. The whole concept

H. Other
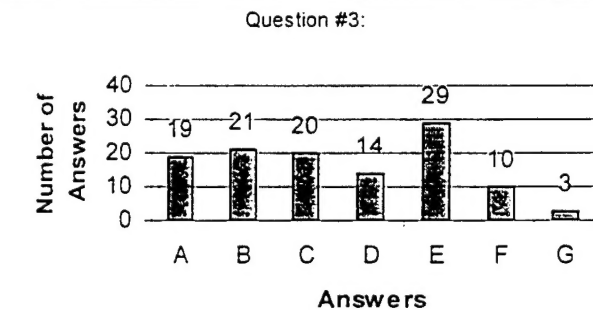
Question #4:

	A	B	C	D
What would it take to make you a believer in the NCW concept?	7	26	19	16
Percentages:	10.29%	38.24%	27.94%	23.53%

Nswers:

A. More information on how NCW will help the warfighter

B. Hard facts and systems engineering designs on the hardware and software that will support NCW.

C. A fully operational system

D. Other

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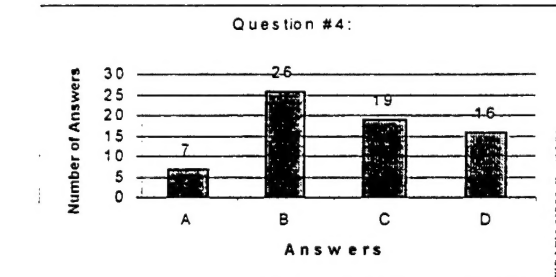
The results:
A small majority (56%) of the people who answered the survey had the view that the NCW concept IS achievable in the next 15 years. Most people thought the greatest challenge to the NCW concept was acceptance of the concept within the DON against other currently planned systems. Most people believed that they need more hard facts along with a fully operational system before they believed that the concept would be viable.